

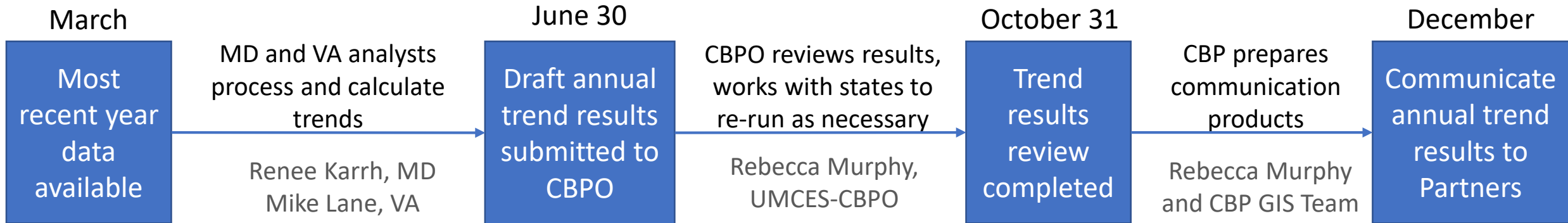
Tidal Trends Products and Indicator Discussion

Jeni Keisman (USGS) and Rebecca Murphy (UMCES)

Status and Trends Meeting

Oct. 10, 2018

Annual Process



Annual Tidal Trends: 10 Parameters

Surface & Bottom, annual:

- Total Nitrogen (TN)
- Dissolved Inorganic Nitrogen (DIN)
- Total Phosphorus (TP)
- Orthophosphate (PO₄)
- Total Suspended Solids (TSS)
- Water Temperature
- Salinity

Surface & Bottom, season-specific:

- Spring & Summer Chlorophyll-a
- Summer Dissolved Oxygen

Water clarity measure, annual:

- Secchi Depth

Annual Tidal Trends: Products

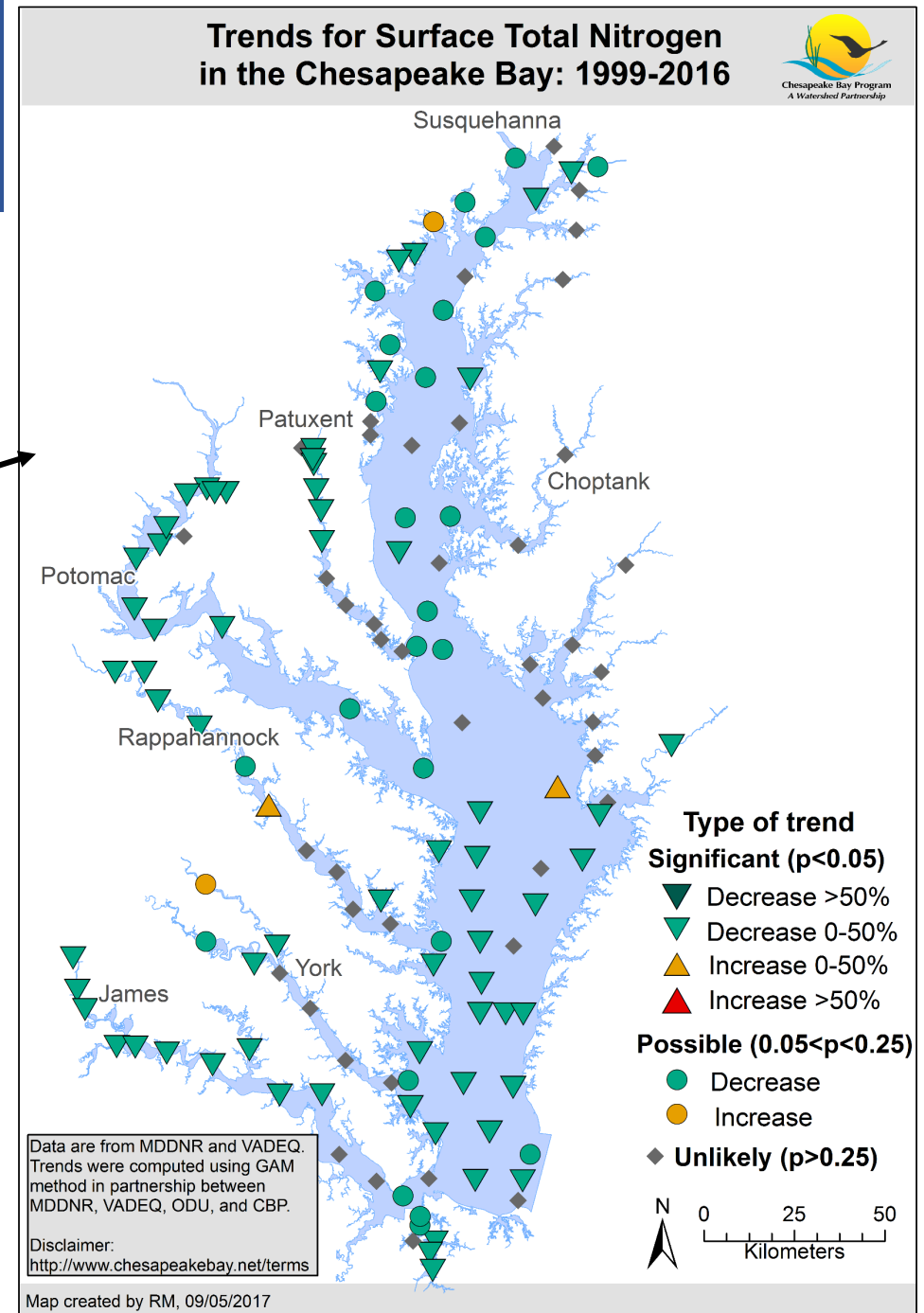
- Long- and short-term
 - Regular and flow-adjusted (from 2017 trends onward)
- } = At least 4 of everything

- 1. Maps: Bay-wide picture of percent change over time**
- 2. Graphs: Data and average pattern over time**
- 3. Tables: Simplified % improving, degrading, not changing**

Annual Tidal Trends: Products

Maps: Regular & Flow-adjusted versions

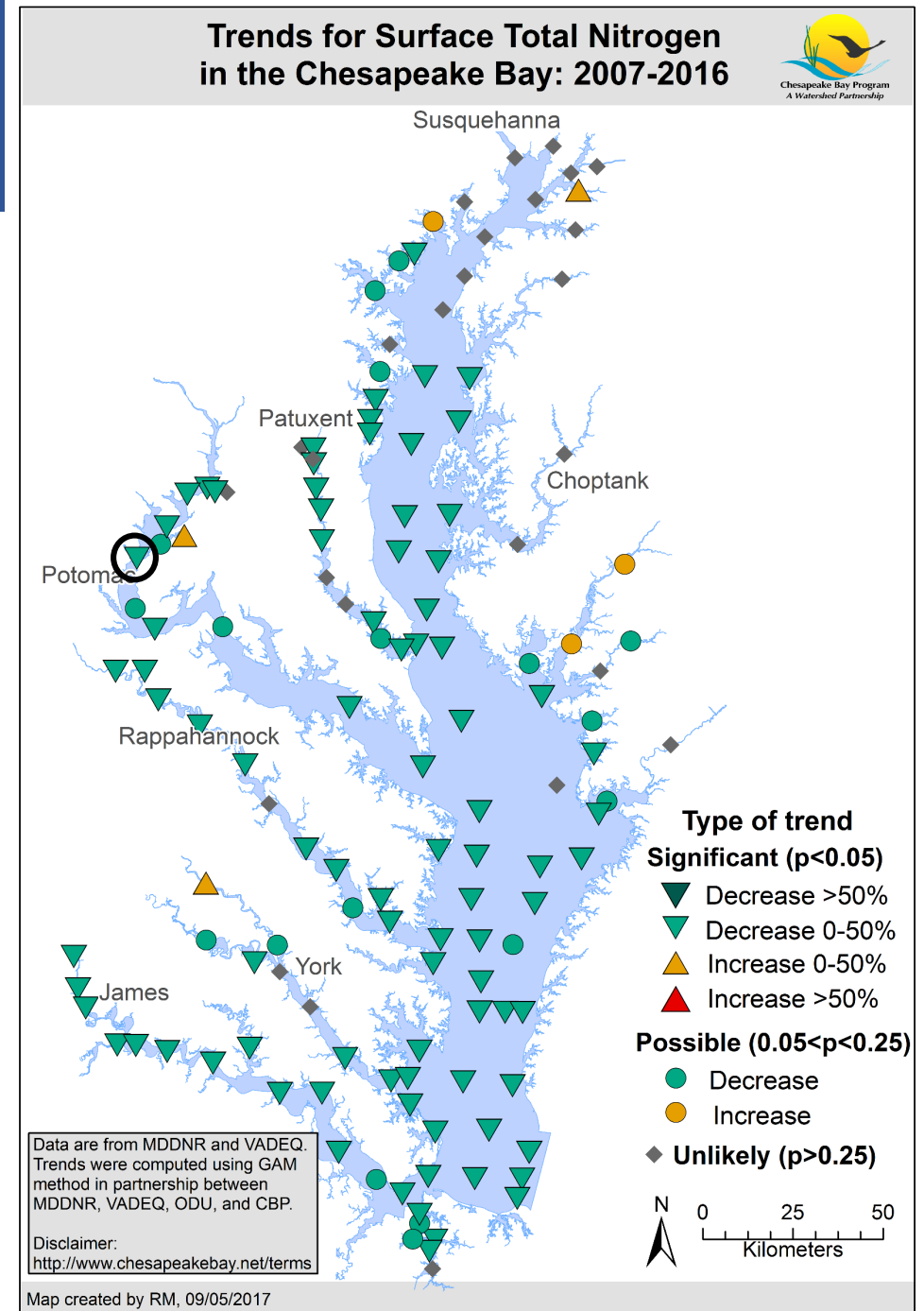
- Long-term (1985 or '99 – present)
- Short-term (last 10 years)



Annual Tidal Trends: Products

Maps: Regular & Flow-adjusted versions

- Long-term (1985 or '99 – present)
- Short-term (last 10 years)



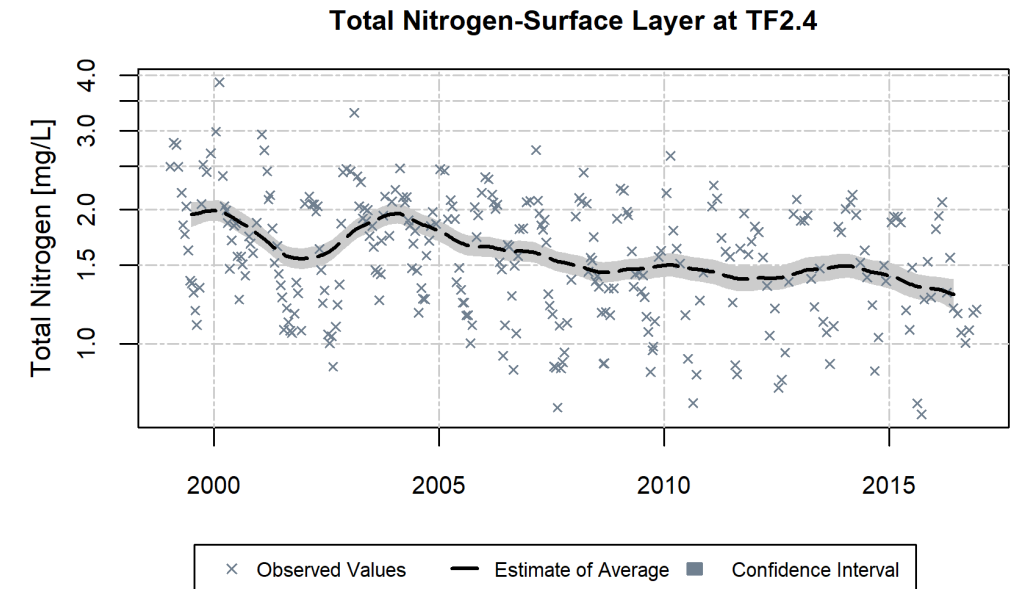
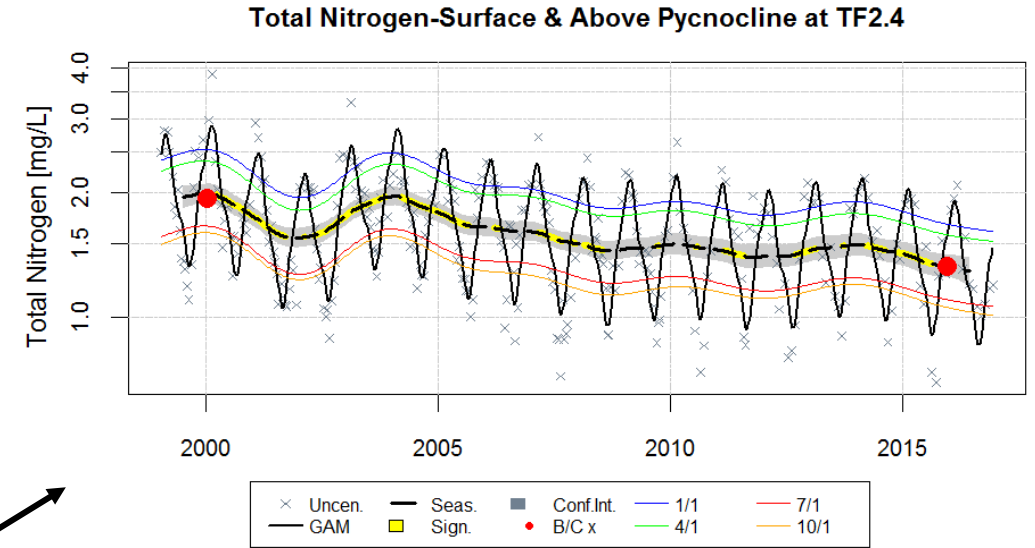
Annual Tidal Trends: Products

Maps: Regular & Flow-adjusted versions

- Long-term (1985 or '99 – present)
- Short-term (last 10 years)

Graphs:

- Detailed for scientific audience
- Simplified



Annual Tidal Trends: Products

Maps: Regular & Flow-adjusted versions

- Long-term (1985 or '99 – present)
- Short-term (last 10 years)

Graphs:

- Detailed for scientific audience
- Simplified version for website/reports

Tables:

- Summary of improving, degrading, no change

Surface TN 2007-2016 Trends	
Trend in TN concentration	Percent of Stations
Significant ^a decrease (improvement)	63%
Significant increase (degradation)	2%
No significant trend	35%

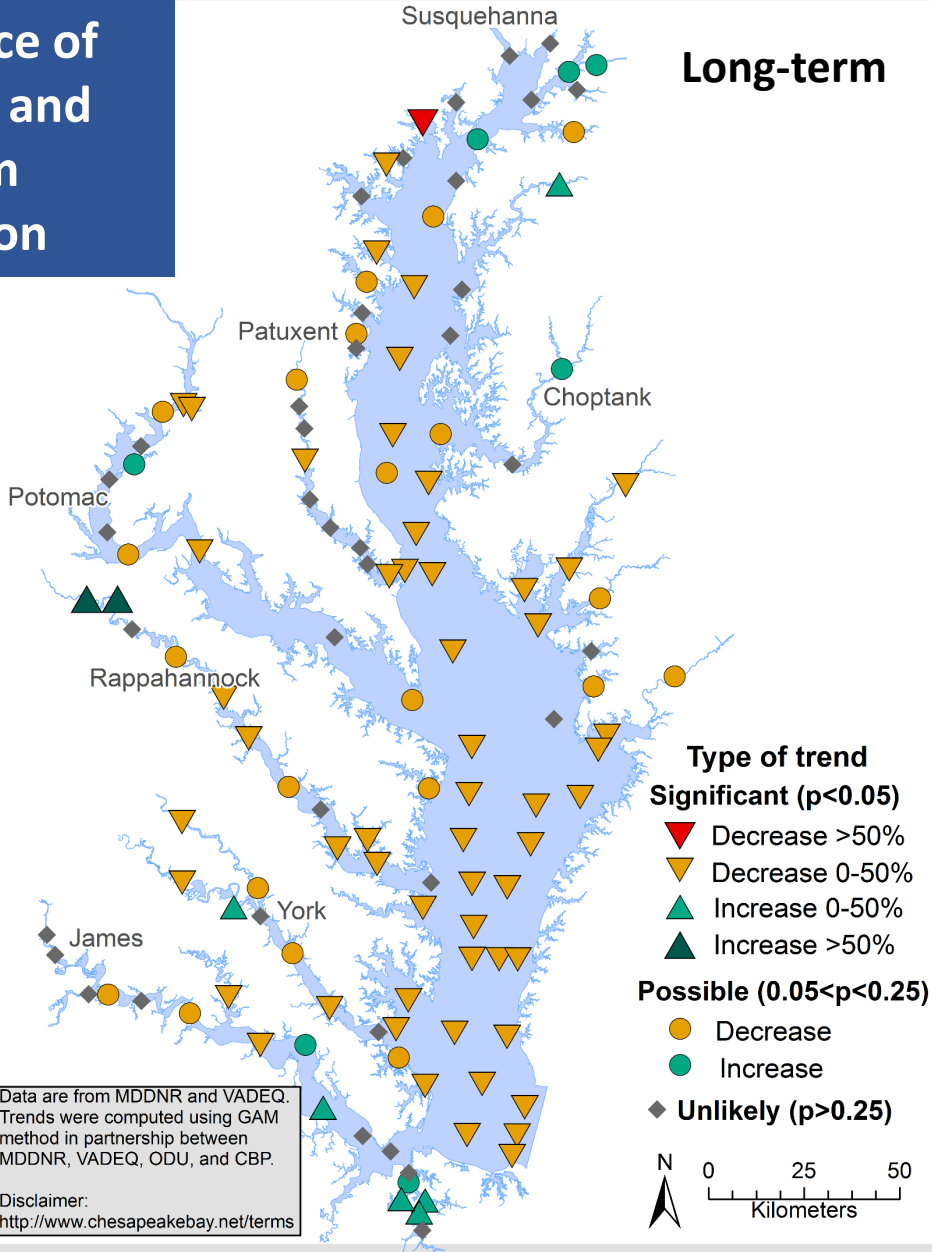
^a Trends counted significant if $p < 0.05$

Trends for Secchi Disk Depth in the Chesapeake Bay: 1985-2016



**Example:
Importance of
both long and
short term
information**

Long-term

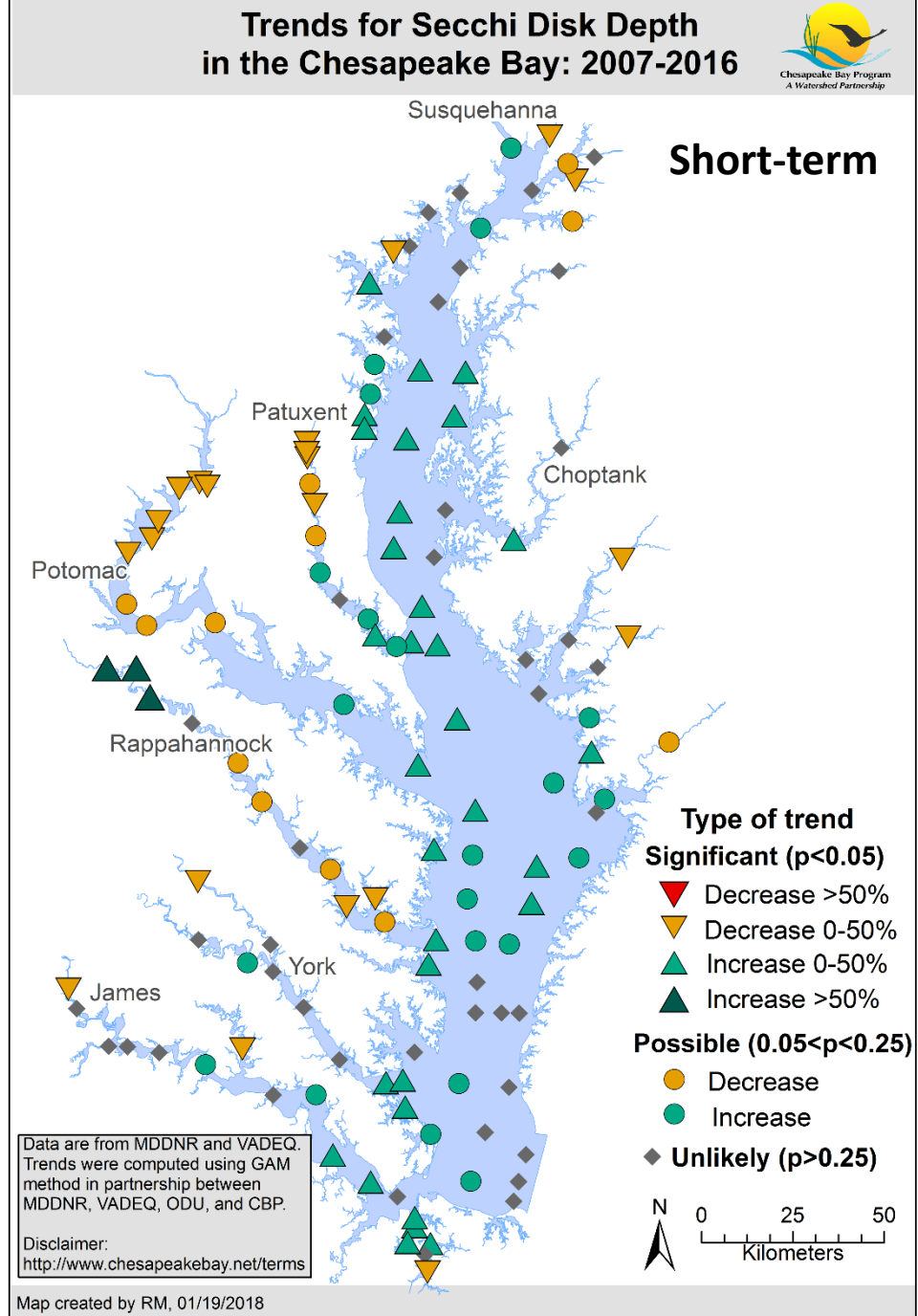
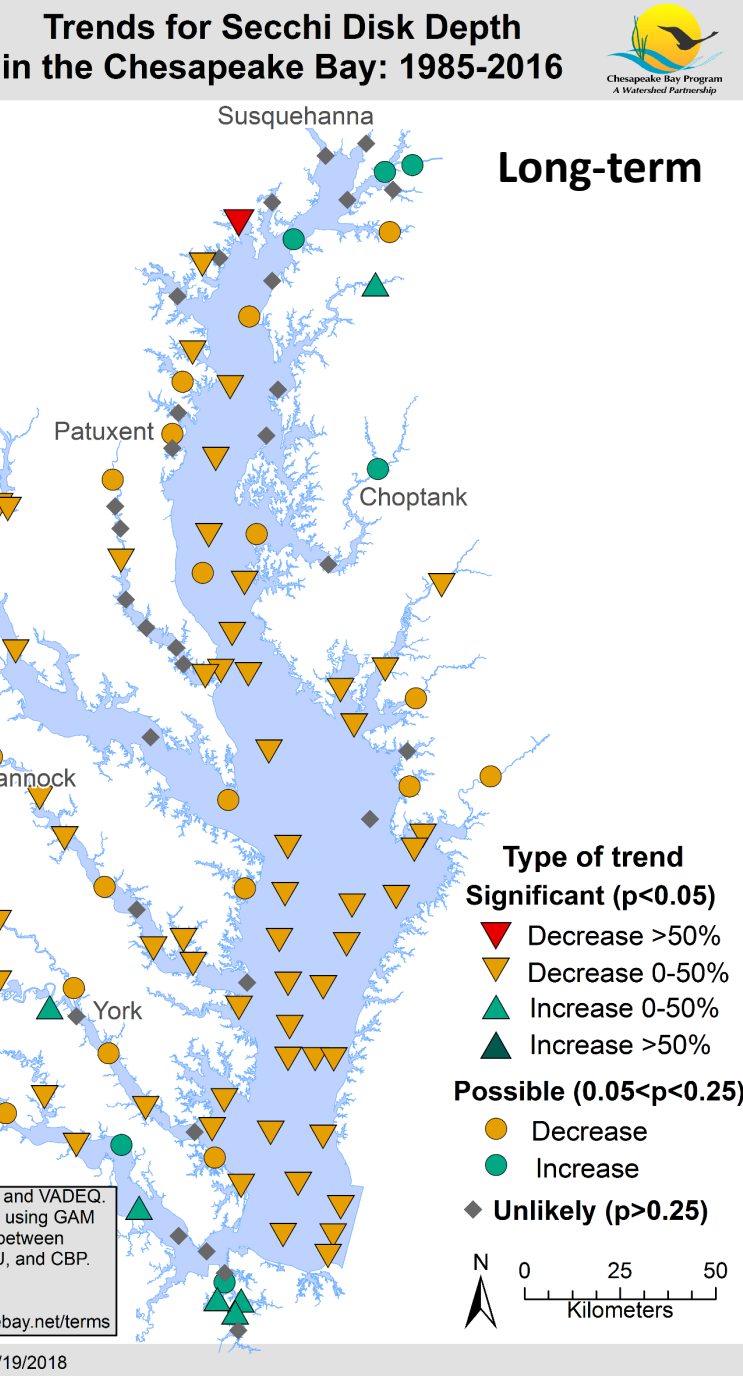


Data are from MDDNR and VADEQ. Trends were computed using GAM method in partnership between MDDNR, VADEQ, ODU, and CBP.

Disclaimer:
<http://www.chesapeakebay.net/terms>

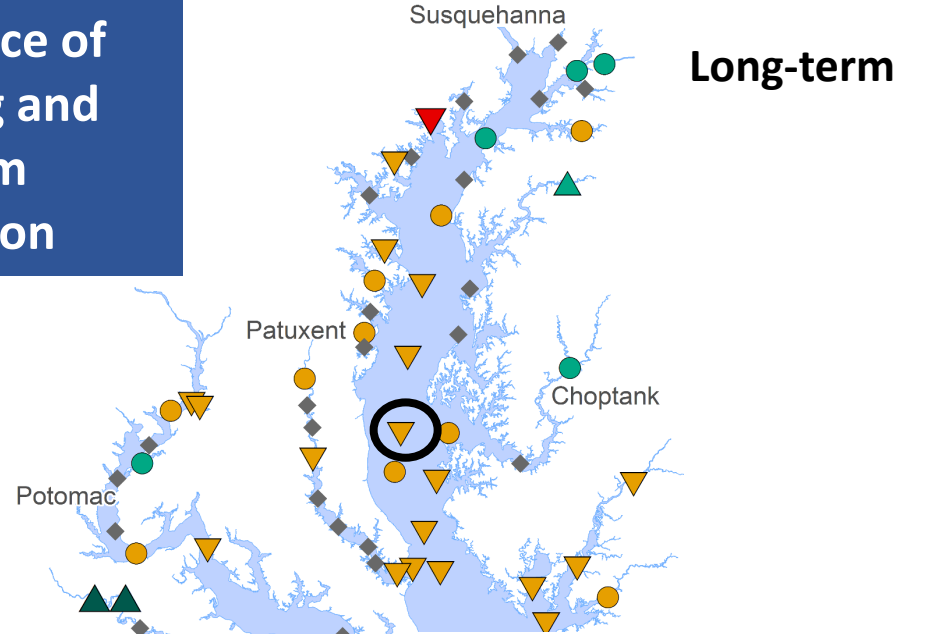
Map created by RM, 01/19/2018

**Example:
Importance of
both long and
short term
information**

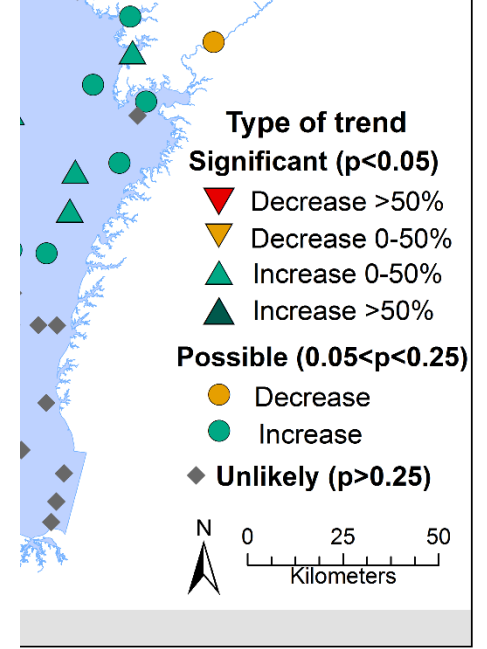
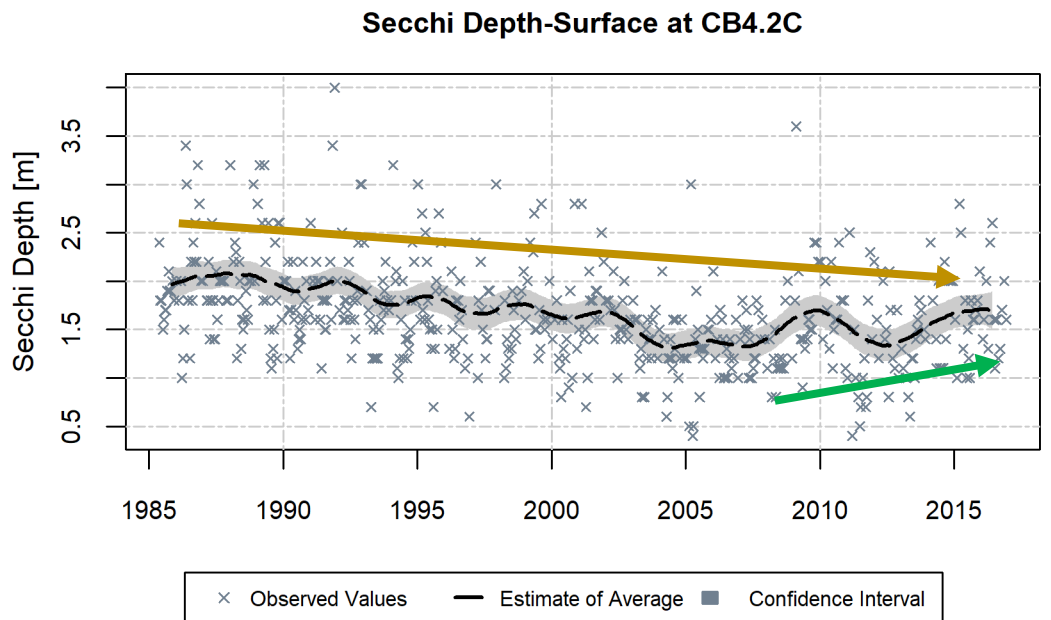
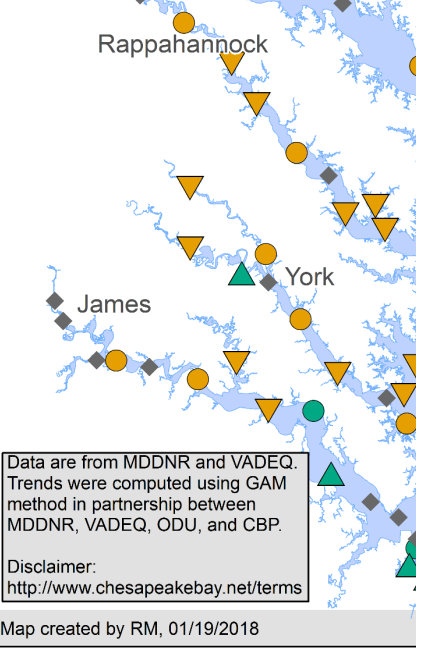
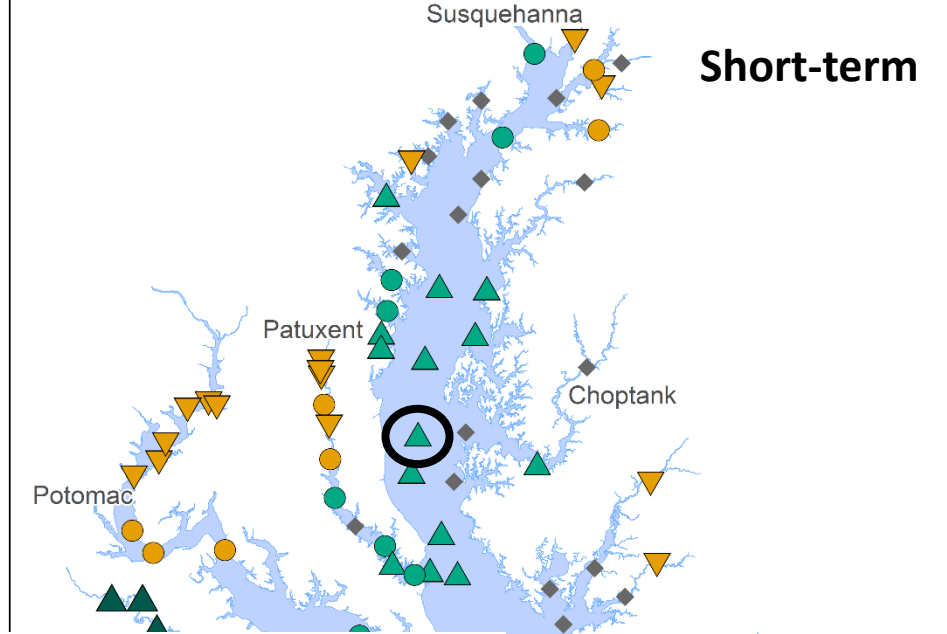


**Example:
Importance of
both long and
short term
information**

**Trends for Secchi Disk Depth
in the Chesapeake Bay: 1985-2016**



**Trends for Secchi Disk Depth
in the Chesapeake Bay: 2007-2016**



**Example:
Importance of
both long and
short term
information**

Water Clarity Measure: Secchi Disk Depth

Long-term

1985-2016 Trends	
Trend in Secchi depth	Percent of Stations
Significant increase (improvement)	7%
Significant decrease (degradation)	42%
No significant trend	51%

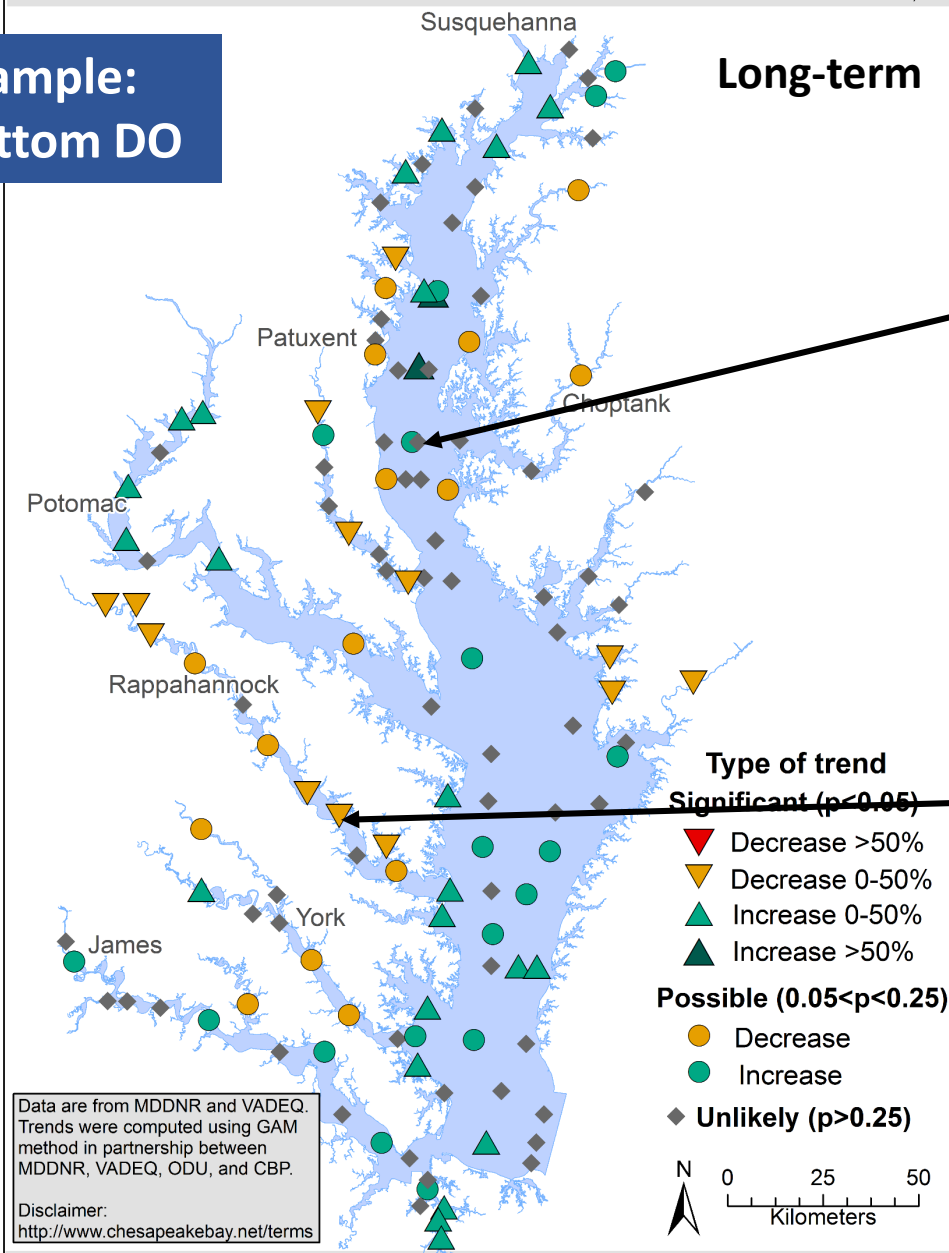
Short-term

2007-2016 Trends	
Trend in Secchi depth	Percent of Stations
Significant increase (improvement)	26%
Significant decrease (degradation)	16%
No significant trend	58%

Trends for Summer Bottom Dissolved Oxygen in the Chesapeake Bay: 1985-2016 (June-Sept)



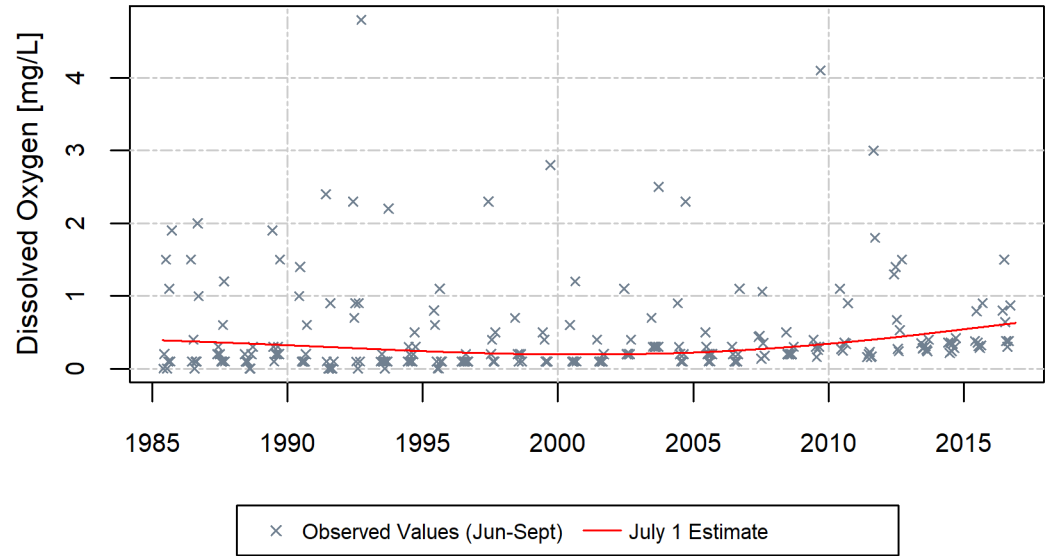
**Example:
Bottom DO**



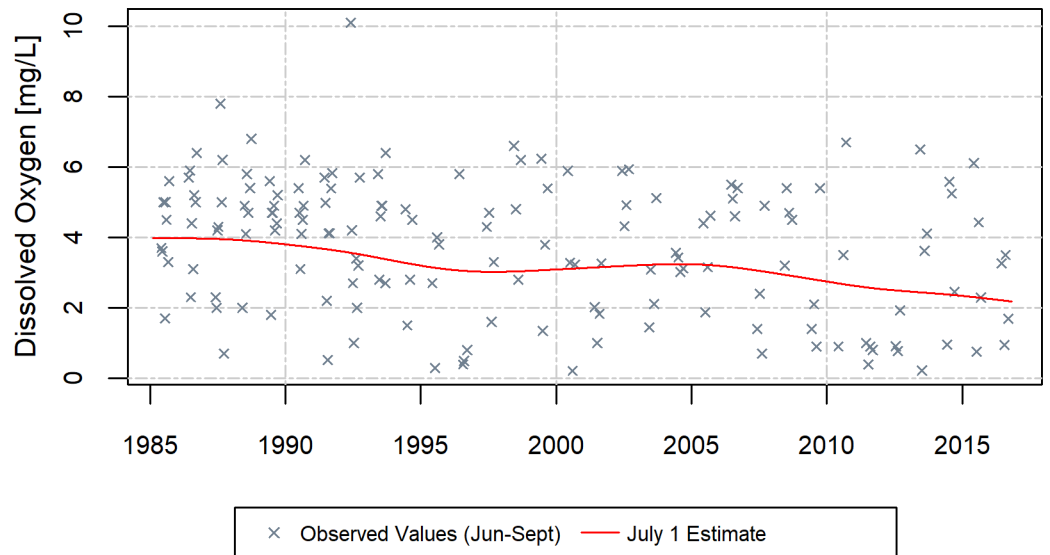
Data are from MDDNR and VADEQ. Trends were computed using GAM method in partnership between MDDNR, VADEQ, ODU, and CBP.
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Map created by RM, 01/19/2018

Summer Dissolved Oxygen-Bottom at CB4.2C



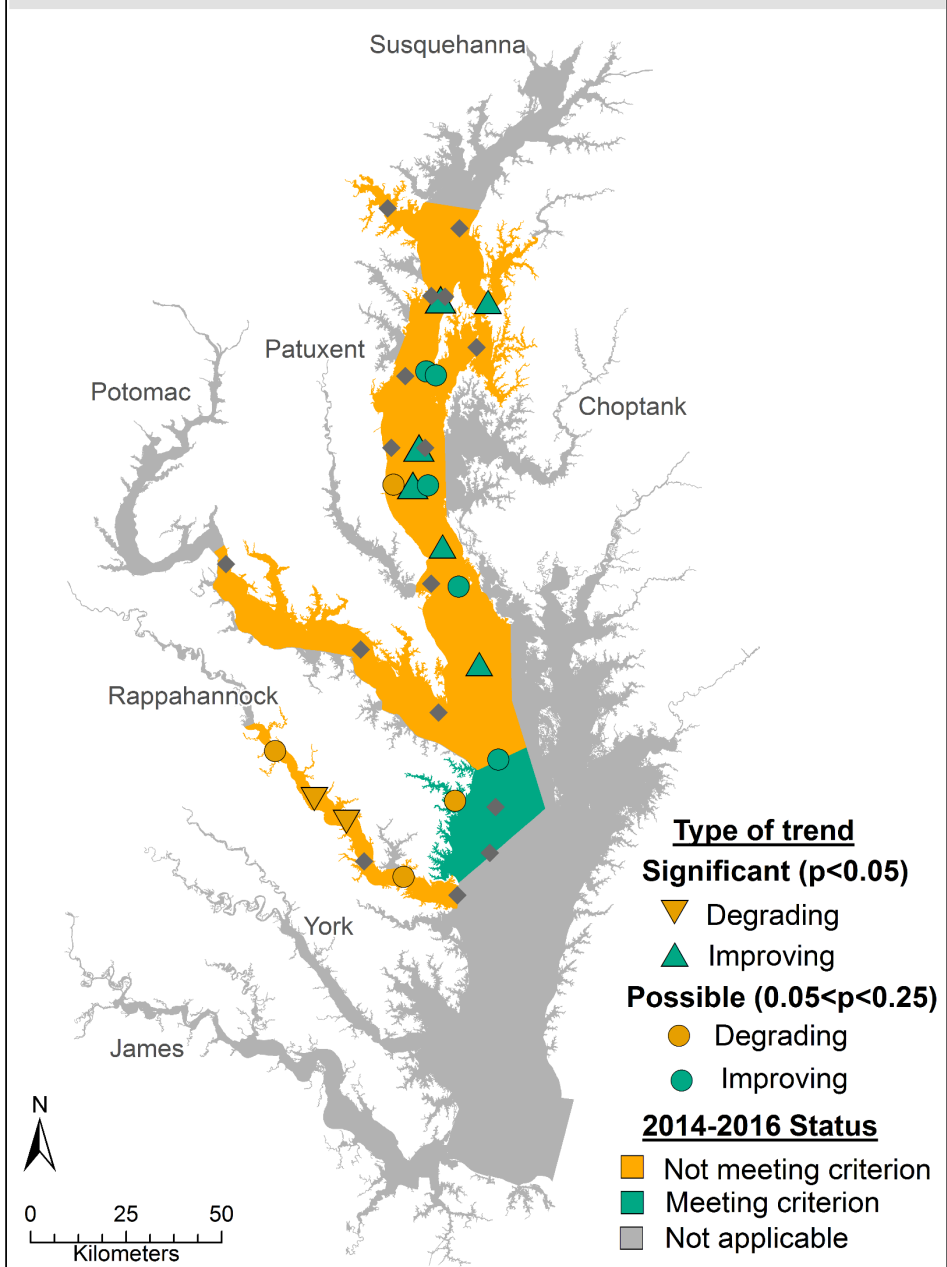
Summer Dissolved Oxygen-Bottom at LE3.1



**Example:
Bottom DO
and water
quality criteria**

Making the link between
water quality criteria
attainment status and DO
trends

**Deep Channel Oxygen Criterion Status for 2014-2016
and Trends for Bottom Surface Oxygen for 2007-2016**



Current availability of tidal trends products

- Integrated Trends Analysis Team website
- From us directly when requested
- WIP data dashboard, tidal page (in development)

The screenshot shows the website for the Integrated Trends Analysis Team. The page is titled "Integrated Trends Analysis Team" and includes a navigation menu with options like "Discover the Chesapeake", "Learn the Issues", "State of the Chesapeake", "Take Action", "In the News", "Who We Are", and "What We Do". The main content area is divided into several sections:

- No upcoming meetings.** A section indicating that there are no upcoming meetings, with links to "View Past Meetings" and "Meeting Calendar".
- Scope and Purpose.** A section describing the team's mission to combine the efforts of Chesapeake Bay Program analysts with those of external investigators to identify research synergies and collaborations. It lists specific goals and membership information.
- Projects and Resources.** A section listing various projects and resources, including "Maps of 2016 Tidal Trends" and "Maps of Tidal Trends: Short Term - Surface".
- Maps of Tidal Trends: Short Term - Surface.** A list of maps for the 2007-2016 period, including Annual Surface Total Nitrogen, Annual Surface Dissolved Inorganic Nitrogen, Annual Surface Total Phosphorus, Annual Surface Orthophosphate, Annual Surface Chlorophyll-a, Annual Surface Total Suspended Solids, Annual Secchi Disk Depth, and Annual Water Temperature.
- Maps of Tidal Trends: Short Term - Bottom.** A list of maps for the 2007-2016 period, including Annual Bottom Total Nitrogen, Annual Bottom Dissolved Inorganic Nitrogen, Annual Bottom Total Phosphorus, Annual Bottom Orthophosphate, Annual Bottom Chlorophyll-a, Annual Bottom Total Suspended Solids, Summer Bottom Dissolved Oxygen, and Annual Bottom Water Temperature.
- Maps of Tidal Trends: Long Term - Bottom.** A list of maps for the 1999-2016 period, including Annual Bottom Total Nitrogen, Annual Bottom Dissolved Inorganic Nitrogen, Annual Bottom Total Phosphorus, Annual Bottom Orthophosphate, Annual Bottom Chlorophyll-a, Annual Bottom Total Suspended Solids, Summer Bottom Dissolved Oxygen, and Annual Bottom Water Temperature.
- Maps of Tidal Trends: Long Term - Surface.** A list of maps for the 1999-2016 period, including Annual Surface Total Nitrogen, Annual Surface Dissolved Inorganic Nitrogen, Annual Surface Total Phosphorus, Annual Surface Orthophosphate, Annual Surface Chlorophyll-a, Annual Surface Total Suspended Solids, Annual Surface Secchi Disk Depth, and Annual Water Temperature.
- GAM Documentation.** A section listing various documentation files, including Draft-GAM Method for Chesapeake 5-10-18, Appendix 1A Baytrends Quick Start Instructions, Appendix 2.1A example R Package Files, Appendix 2.3A - QW Data Format, Appendix 2.4A Ex GAM Models, Appendix 2.5A Percent Change, Appendix 2.6A Censored Data Approaches, Appendix 2.6B Summary of Censoring, Appendix 2.6C Censoring Scenarios, Appendix 2.7A Lab. Change Approach, and Appendix 2.8A Create Seasonally Detrended Flow and salinity Data sets.

On the right side of the page, there is a "Members" section with a plus sign, and a "How To's & Tips" section with links to "Visit the Chesapeake", "Find a Group", "Attend an Event", and "Newsletters".

Discussion

- Does the CBP have a “release” process that is appropriate for the tidal trends results?
- Who are the appropriate audiences for this information?
 - Technical environmental managers within jurisdiction agencies
 - Watershed and tributary groups (e.g. Riverkeepers)
 - Research community
 - ?
- Should there be a tidal trends indicator?
- Where should these products be housed and served?